Consolidated Space Operations Contract

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FROM: AS&T/Information Data Management

SUBJECT: DCN 001 to WDISC System Requirements

Attached is DCN 001 to the WDISC System Requirements document. This DCN is a result of system changes pertaining to the move of Network Control Center operations from GSFC to the White Sands Complex Data Services Management Center. Discard the current System Requirements document and replace with the attached.

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NCC Miscellaneous Systems (NCCMS)
Sustaining Engineering Review Board (SERB) for the WDISC

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Original
(Supersedes 451-WDISC-SRD-98)

Consolidated Space Operations Contract

WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) System Requirements

June 30, 2001

Effective: June 30, 2001

Contract NAS9-98100

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This document supersedes WSC Transmission Control protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) System Requirements, 451-WDISC-SRD 98, July 1998. Dispose of superseded documents in accordance with CSOC-CEN-SOP-000205.

Change Information Page

List of Effective Pages		
Page Number	**Version**	**Nature of Change**
Cover	Original	
Signature Page	Original	
DCN Control Sheet	Original	
Preface	DCN 001	See Cover Memo
vi and vii	Original	
1-1 and 1-2	DCN 001	See Cover Memo
1-3	Original	
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3-1 through 3-4	DCN 001	See Cover Memo
4-1 through 4-4	DCN 001	See Cover Memo
5-1 and 5-2	DCN 001	See Cover Memo
6-1	DCN 001	See Cover Memo
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001	Printed	04/03	Preface, 1, 2, 3, 4, 5, 6, Appendix A	SL

Preface

This document specifies the system requirements of the White Sands Complex (WSC) Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC), that includes general requirements, forward service requirements, return service requirements, record and playback requirements, and support requirements.

This document was originally created under National Aeronautical and Space Administration (NASA) control. The WDISC system has been converted to Consolidated Space Operations Contract (CSOC) control and thus this document has been converted to CSOC control. This document was originally published in July 1998. Upon conversion, the document has retained most of its original content with the exception of an update to the list of WDISC customers and reference document list, both of which are in Section 1. Some of the document was updated in DCN 001 to reflect the move of NCC to DSMC/WSC and to provide more details on the client/server roles and playback capabilities.

This document is under configuration management of the Goddard Space Flight Center Network Control Center Miscellaneous Systems (NCCMS) Sustaining Engineering Review Board (SERB).

Proposed changes to this document must be submitted to the SERB along with supportive material justifying the proposed change.

Changes to this document will be made by Documentation Change Notice (DCN) or complete revision.

Comments or questions concerning this document and proposed changes shall be addressed to WDISC Sustaining Engineering:

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Contents

Section 1. Introduction

1.1 Background

NASA's Space Network (SN) provides Tracking and Data Acquisition (T&DA) services for a variety of user spacecraft. The primary SN elements are the Tracking and Data Relay Satellites (TDRSs), the Data Services Management Center (DSMC) and the White Sands Complex (WSC) which includes the White Sands Ground Terminal (WSGT) and the Second TDRSS Ground Terminal (STGT). For all normal operational support, the TDRSs and the WSC operate according to schedules developed by the Network Control Center Data System (NCCDS) within the DSMC in response to requests submitted by the SN customers.

WDISC has supported or will support the following customers:

a. Far Ultraviolet Spectroscopy Explorer (FUSE).

b. Galaxy Evolution Explorer (GALEX).

c. Gravity Probe B (GP-B).

d. Landsat-7.

e. Long Duration Balloon (LDB).

f. New Millennium Program Earth Orbiter-1 (NMP/EO-1).

g. Thermosphere Ionosphere Mesosphere Energetic Dynamics (TIMED).

h. Ultra Long Duration Balloon (ULDB).

Support for the WDISC and its customers is provided by the NASA Integrated Services Network (NISN) Internet Protocol (IP) Operational Network (IONET). Each customer's IONET bandwidth requirements must be negotiated with SN and NISN prior to the commencement of tests and operations.

This document specifies the system requirements for the WDISC.

1.2 General Description

The WDISC is to provide the following capabilities:

a. Receive encapsulated forward service data from a customer Mission Operations Center (MOC) via the Closed IP Operational Network (IONET), convert data to serial form, and present it to a WSC Local Interface (LI) port.

b. Receive serial return service data from a WSC LI port, encapsulate it, and transmit it to a customer MOC via the Closed IONET.

c. Data monitoring.

d. Data recording.

e. Data playback.

1.3 Reference Documents

The following documents are considered reference materials, which have relevancy to this document:

a. WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Project Management Plan (PMP), CSOC-GSFC-PLAN-002094.

b. WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Operations Concept, CSOC-GSFC-OC-002091.

c. Detailed Mission Requirements (DMR) Document for the Gravity Probe-B Mission (GP-B), 450-215/GP-B.

d. Detailed Mission Requirements (DMR) Document for the New Millennium Program Earth Orbiter-1 (NMP/EO-1), 450-215/EO-1.

e. EO-1 Spacecraft to Ground Interface Control Document, No Identifier.

f. Requirements Specification for the White Sands Complex (WSC), 530-RSD-WSC.

g. Space Network (SN) User's Guide, 530-SNUG.

h. PTP NT Programmable Telemetry Processor for Windows NT, User's Manual, Version 1.40, November 1998.

i. AVTEC PTP for Windows, Programmable Telemetry Processor User’s Guide, Version 1.49, July, 19, 2001.

j. NASA Communications (Nascom) Programmable Telemetry Processor (PTP) Installation and Troubleshooting Guide, No Identifier.

k. Interface Control Document (ICD) Between the Network Control Center (NCC)/Flight Dynamics Facility (FDF) and the White Sands Complex (WSC), 530-ICD-NCC-FDF/WSC.

l. WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Service Specifications, CSOC-GSFC-RD-002056.

m. NASA Automated Information Security Handbook, NHB 2410.9A.

n. NASA - Goddard Space Flight Center Security Manual, GHB 1600.1A.

o. Data Services Management Center System Requirements Specification, Rev D., DCN 001. August 2002, CSOC-CEN.SE11.001070.

NOTE

GHB 1600.1A has been amended via letter from GSFC Code 205.1, subject: Center Interim Guidance for Information Technology Security (ITS), dated March 5, 1998. Enclosure 15 to this letter contains a revised version of the ITS Minimum Baseline Protective Requirements matrix which supersedes earlier versions of this matrix contained in NHB 2410.9A and GHB 1600.1A.

Section 2. General Requirements

2.1 General

The general WDISC requirements apply to:

a. Operational control.

b. Data monitoring.

c. TDRS availability.

d. WDISC reliability/maintainability/availability.

e. Year 2000 compliance.

f. Security.

2.2 Operational Control

2.2.1 General

The WDISC shall provide the capability for remote operation of all WDISC functions other than those that are inherently local such as mounting of removable media. Remote monitoring and control systems for the WDISC are located at the GSFC and WSC. The interface between the WDISC and the remote control systems shall be via the Closed IONET.

2.2.2 Data Channel Processing Specifications

Operational control of the WDISC is effected by selection and activation of previously defined data channel processing specifications (i.e., desktops).

a. The WDISC shall provide the following functional capabilities for the maintenance of data channel processing specifications:

   1. Create and store new data channel processing specifications.

   2. Retrieve, edit, and store data channel processing specifications.

b. The WDISC shall have the capacity to store at least 10 data channel processing specifications.

c. The WDISC shall provide the capability to select and activate any stored data channel processing specification.

d. Within 10 seconds of receipt of the control information needed to activate a selected data channel processing specification, the WDISC shall be capable of performing all functions specified by the selected data channel processing specification.

2.3 Data Monitoring

The WDISC shall monitor customer forward and return service data, and make data monitoring status information available to the remote control operations interfaces.

2.4 TDRS Availability

Unless limited by other operational considerations, all TDRSs are to be available to SN customers using the WDISC. The WDISC shall be configured such that it can flow serial data to and from WSC LI ports at both WSGT and STGT.

2.5 WDISC Reliability/Maintainability/Availability

2.5.1 General

All of the missions that have selected WDISC for SN support require it for their launch support unless they are already on-orbit and subsequently have selected WDISC (such as Lasdsat-7) for SN support. In order to preclude launch slips due to WDISC failures, the WDISC must be highly reliable.

2.5.2 Failure

A WDISC failure is defined as the loss of the capability to perform any of the following essential functions:

a. Retrieve and activate a forward or return service data channel processing specification. Refer to paragraph 2.2.2 c.

b. Flow forward service data. Refer to Section 3.

c. Flow return service data. Refer to Section 4.

2.5.3 Reliability

The WDISC shall have a mean time between failures (MTBF) of at least 2500 hours.

2.5.4 Time to Restore to Operations

Following detection of a failure, the WDISC shall be capable of being restored to operations within 15 minutes. Automated failover or recovery is not required. The procedures for restoring the WDISC to operations may involve retrieval and activation of data channel processing specifications, and may require the MOCs to reestablish TCP/IP connections or to provide forward data flow configuration control information.

2.5.5 Availability

Herein, availability is defined as the quotient of MTBF divided by the sum of the MTBF and the time to restore to operations. The WDISC availability is to be at least 0.9999.

2.5.6 Diagnostics

In order to facilitate reliable WDISC operations, the WDISC shall include software to:

a. Log and delog control, status, and error messages.

b. Diagnose hardware and isolate faults to replaceable components.

2.6 Year 2000 Compliance

The WDISC shall be fully Year 2000 (Y2K) compliant.

2.7 Security

The WDISC functions within the SN, and therefore must include security capabilities consistent with this role. The WDISC is designated as a Sensitivity Level-3 system, and shall comply with all security requirements applicable to Sensitivity Level-3 systems as specified by the NASA Automated Information Security Handbook, NHB 2410.9A and the NASA – Goddard Space Flight Center Security Manual, GHB 1600.1A.

Section 3. Forward Service Requirements

3.1 General

Prior to scheduling the WDISC to support a SN forward service, one or more WDISC forward data channel processing specifications must be defined. Sometime prior to the scheduled service start time, a WDISC forward data channel processing specification (i.e., desktop), will be activated. In accord with this specification, the WDISC will receive encapsulated forward service data from a customer MOC via the Closed IONET, convert the forward service data to serial form, and present it to a WSC LI port.

3.2 Forward Service Data Channel Processing Specifications

The WDISC forward service data channel processing specifications shall include the following information:

a. Valid MOC TCP/IP address.

b. LI port number.

c. Data processing requirements.

d. Data monitoring requirements.

3.3 Interfaces

3.3.1 MOC

For forward services, the WDISC shall have a client/server relationship with the customer MOC and shall be capable of being either the client or the server in this relationship.

NOTE

The details of this interface are specified in WSC Transmission Control Protocol (TCP)/Internet Protocol (IP)Data Interface Service Capability (WDISC) Service Specifications (reference k.).

3.3.1.1 Client Role

Upon activation of a forward service data channel processing specification, as the client, the WDISC shall:

a. Initiate a TCP/IP connection request to the MOC server.

b. Accept forward data flow configuration control information from the MOC.

c. Provide periodic system status information to the MOC.

d. Be capable of receiving encapsulated forward service data from the MOC server via the Closed IONET.

3.3.1.2 Server Role

Upon activation of a forward service data channel processing specification, as the server, the WDISC shall:

a. Allow a TCP/IP connection to be established from the client MOC.

b. Accept forward data flow configuration control information from the MOC.

c. Provide periodic system status information to the MOC.

d. Be capable of receiving encapsulated forward service data from the client MOC via the Closed IONET.

3.3.2 WSC

When a forward service data channel processing specification is active, the WDISC shall:

a. Use forward data flow configuration control information provided by the MOC to set the data switch between the WDISC and the WSC LI port to the indicated state.

b. Present serial forward data provided by the MOC to the specified LI port.

3.4 Data Processing

3.4.1 General

For each active forward service data channel processing specification, the WDISC shall be capable of converting forward service data from encapsulated form to serial form. If indicated by the active forward service data channel processing specification, the WDISC shall perform:

a. Differential encoding

b. Data randomization.

c. Idle pattern generation.

3.4.2 NMP/EO-1

To provide the required SN forward service for NMP/EO-1, the WDISC is to be capable of providing forward service data channel data handling in one mode:

a. If command data from the MOC is present, the WDISC shall perform the following:

1. Conversion of command data from encapsulated data form to serial data form.

2. Presentation of serial data to the WSC LI port.

3.4.3 GP-B

To provide the required SN forward service for GP-B, the WDISC is to be capable of providing forward service data channel data handling in one mode:

a. If command data from the MOC is present, the WDISC shall perform the following:

   1. Conversion of command data from encapsulated data form to serial data form.

   2. Presentation of serial data to the WSC LI port.

b. If command data is not present, the WDISC shall generate an alternating one/zero idle pattern and present it to the WSC LI port.

c. The WDISC shall transition from command data not present to command data present without interruption in the flow of serial data.

d. Upon transition from command data present to command data not present, the WDISC shall automatically resume generation of the alternating one/zero idle pattern.

3.5 Data Monitoring

If indicated by the active forward service data channel processing specification, the WDISC shall:

a. Monitor forward service data.

b. Provide data monitoring status information to the local operations interface.

c. Provide data monitoring status information to the non-MOC remote control operations interface.

3.6 Service Reconfiguration

There are no requirements for reconfiguration of on-going forward services.

3.7 Performance

3.7.1 Data Channels

At each of WSGT and STGT, the WDISC shall be capable of supporting at least three simultaneously scheduled SN forward service data channels.

3.7.2 Data Rates

3.7.2.1 General

The WDISC shall allow a forward service single channel data rate from 100 bps to at least 50 kbps.

NOTE

Higher single channel forward service data rates may be possible; however, rates above 50 kbps have the potential to cause overloading of the WDISC. If a customer has a higher forward service data rate requirement, workload analysis and testing will be necessary to ensure that reliable operation is possible.

3.7.2.2 NMP/EO-1

The WDISC shall provide support at one data rate: One Kbps. This is applicable to SSAF.

3.7.2.3 GP-B

The WDISC shall provide support at two data rates:

a. 125 bps. This is applicable to Multiple Access Forward (MAF).

b. Two kbps. This is applicable to S-band Single Access Forward (SSAF).

Section 4. Return Service Requirements

4.1 General

Prior to scheduling the WDISC to support a SN return service, one or more WDISC return data channel processing specifications must be defined. Sometime prior to the scheduled service start time, a WDISC return data channel processing specification (i.e., desktop), will be activated. In accord with this specification, the WDISC will receive return service serial data from a WSC LI port, encapsulate the data, and transmit it to a customer MOC via the Closed IONET.

4.2 Return Service Data Channel Processing Specifications

The WDISC return service data channel processing specifications shall include the following information:

a. Valid MOC TCP/IP address.

b. LI port number.

c. Data processing requirements.

d. Data monitoring requirements.

e. Data logging requirements.

4.3 Interfaces

4.3.1 MOC

For return services, the WDISC shall have a client/server relationship with the customer MOC and shall be capable of being either the client or the server in this relationship.

NOTE

The details of this interface are specified in WSC Transmission Control Protocol (TCP)/Internet Protocol (IP)Data Interface Service Capability (WDISC) Service Specifications (reference k.).

4.3.1.1 Client Role

Upon activation of a return service data channel processing specification, as the client, the WDISC shall:

a. Initiate a TCP/IP connection to the MOC server.

b. Be capable of transmitting encapsulated return service data to the MOC server via the Closed IONET.

4.3.1.2 Server Role

Upon activation of a return service data channel processing specification, as the server, the WDISC shall:

a. Allow a TCP/IP connection to be established from the client MOC.

b. Be capable of transmitting encapsulated return service data to the client MOC via the Closed IONET.

4.3.2 WSC

Upon activation of a return service data channel processing specification, the WDISC shall be capable of receiving serial return data from the specified LI port. In addition, the WDISC shall accept Inter-range instrumentation Group-B (IRIG-B) time data provided by the WSC and use it as needed to time tag return service data.

4.4 Data Processing

4.4.1 General

For each active return service data channel processing specification, the WDISC shall be capable of performing frame synchronization and conversion of Consultative Committee for Space Data Systems (CCSDS)-compliant return service data from serial form to encapsulated form. If indicated by the active return service data channel processing specification, the WDISC shall perform:

a. Time tagging with an accuracy of least 10 milliseconds.

b. Data de-randomization.

c. Reed-Solomon decoding.

4.5 Data Monitoring

4.5.1 General

If indicated by the active return service data channel processing specification, the WDISC shall:

a. Monitor return service data.

b. Provide data monitoring status information to the local operations interface.

c. Provide data monitoring status information to the non-MOC remote control operations interface.

d. Include data monitoring status information in protocol headers appended to the return service data.

4.5.2 NMP/EO-1

If indicated by the active return service data channel processing specification, the WDISC shall:

a. Monitor return service data.

b. Provide data monitoring status information to the remote control operations interface.

c. Include data monitoring status information in protocol headers appended to the return service data.

4.5.3 GP-B

GP-B requires insertion of data monitoring status information into protocol headers appended to its return service data.

4.6 Logging

4.6.1 General

The WDISC shall be capable of logging all return service data. If indicated by the active return service data channel processing specification, the WDISC shall log the return service data. For each scheduled return service data channel, a return service data channel data processing specification will normally be activated on both a prime and a backup WDISC and will normally specify that data is to be logged. In such cases, the prime and backup WDISC will independently log the same return service data. Also refer to Section 5.

4.6.2 NMP/EO-1

NMP/EO-1 requires that all of its return service data be logged.

4.6.3 GP-B

GP-B requires that all of its return service data be logged.

4.7 Service Reconfiguration

There are no requirements for reconfiguration of on-going return services.

4.8 Performance

4.8.1 Data Channels

At each of WSGT and STGT, the WDISC shall be capable of fully supporting at least three simultaneously scheduled SN return service data channels.

4.8.2 Data Rates

4.8.2.1 General

The WDISC shall allow for a return service single channel data rate from 100 bps to at least 512 kbps.

NOTE

Higher single channel return service data rates may be possible; however, rates above 512 kbps have the potential to cause overloading of the WDISC. If a customer has a higher return service data rate requirement, workload analysis and testing will be necessary to ensure that reliable operation is possible.

4.8.2.2 NMP/EO-1

The WDISC shall provide support at two kbps.

4.8.2.3 GP-B

The WDISC shall provide support at two data rates:

a. 1.024 kbps. This is applicable to MAR.

b. 2.048 kbps. This is applicable to SSAR.

4.8.3 Throughput Delay

The WDISC customers require a SN return service throughput delay of less than four seconds. However, no specific allocation of the SN throughput delay budget is made to the WDISC.

Section 5. Record and Playback Requirements

5.1 General

The WDISC will have the capability to record and playback return service data. There are no applicable requirements for forward service data.

5.2 Recording

If indicated by the active return service data channel processing specification, the WDISC shall log the return service data.

5.3 Playback

5.3.1 General

For return service data, the primary use of the playback capability will be to recover from errors and outages in the normal flow of return data from the WDISC to the MOC. Since the WDISC will have the capability for redundant recording of return service data (refer to paragraph 4.6.1), the WDISC will be capable of recovering any return service data that could not be transmitted in real-time due to WDISC failure (refer to paragraph 2.5.4).

5.3.2 Modes of Use

TBD

5.3.2.1 Recovery via FTP

TBD

5.3.2.2 Data Replay

TBD

5.3.3 MOC Interface

The interface between the WDISC and the MOC varies based upon the mode of playback required.

NOTE

The details of this interface are specified in WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Service Specifications (reference k.).

5.3.3.1 Recovery via FTP

TBD

5.3.3.2 Data Replay

TBD

5.3.3.2.1 Client Role

TBD

5.3.3.2.2 Server Role

TBD

5.3.4 NMP/EO-1

NMP/EO-1 requires that the WDISC be capable of playing back recorded NMP/EO-1 return service data.

5.3.5 GP-B

GP-B requires that the WDISC be capable of playing back recorded GP-B return service data.

5.4 Review

In addition to the playback capability, the WDISC shall provide the capability to retrieve selected recorded data and present it for review.

5.5 On-line Storage Capacity

The WDISC shall be capable of retaining 50 hours of recorded return service data.

Section 6. Support Requirements

6.1 General

Successful operation of the WDISC will require the capability to isolate hardware failures, to replace hardware, to identify faulty software, and to upgrade software.

6.2 Hardware Maintenance

6.2.1 WDISC Operational Responsibilities

WDISC operational responsibilities will be distributed among WSC and DSMC operations personnel. Specific allocations of these responsibilities will be determined as operations procedures are developed. However, it is assumed that the majority of the routine operational responsibilities will be allocated to the DSMC and that WSC personnel will perform only those functions that cannot be performed from the DSMC. WDISC operations personnel shall:

a. Perform routine maintenance in accord with vendor guidelines.

b. Operate diagnostic software and test equipment.

c. Isolate faults to replaceable components.

d. Remove failed replaceable components, and ship them to the vendor.

e. Install vendor-supplied replacements.

6.2.2 Spares

It is herein assumed that the WDISC will be configured redundantly (e.g., a prime and a backup). Therefore, there is no requirement for maintaining an on-site supply of spare components.

6.3 Software Maintenance

WDISC operations personnel shall:

a. Be cognizant of anomalous software behavior.

b. Initiate software trouble reports.

c. Install vendor-supplied software fixes and upgrades.

6.4 Documentation

WDISC operations personnel shall be provided with all documentation needed to perform the functions indicated above.

Appendix A. Abbreviations and Acronyms

Acronym	Definition
CCSDS	Consultative Committee for Space Data Systems
COTS	commercial off-the-shelf
CSOC	Consolidated Space Operations Contract
DIS	Data Interface System
DMR	Detailed Mission Requirements
DSMC	Data Services Management Center
EO-1	Earth Orbiter-1
FTP	File Transfer Protocol
FUSE	Far Ultraviolet Spectroscopy Explorer
GP-B	Gravity Probe B
GSFC	Goddard Space Flight Center
ID	identifier
IONET	IP Operational Network
IP	Internet Protocol
IPDU	IP data unit
LDB	Long Duration Balloon
LEO-T	Low Earth Orbit-terminal
LI	local interface
MOC	Mission Operations Center
MTBF	Mean Time Between Failure
NASA	National Aeronautics and Space Administration
NCCDS	Network Control Center Data System
NCCMS	Network Control Center Miscellaneous Systems
NISN	NASA Integrated Services Network
NMP	New Millennium Program
NMP-EO-1	New Millennium Program Earth Orbiter-1
PMP	Project Management Plan
PTP	Programmable Telemetry Processor
SERB	Sustaining Engineering Review Board

Acronym	Definition
SFDU	standard formatted data unit
SN	Space Network
STGT	Second TDRSS Ground Terminal
TCP	Transmission Control Protocol
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TIMED	Thermosphere Ionosphere mesosphere Energetic Dynamics
UIFC	user interface channel ID
ULDB	Ultra Long Duration Balloon
USM	user schedule message
WDISC	WSC TCP/IP Data Interface Service Capability
WSC	White Sands Complex
WSGT	White Sands Ground Terminal

CSOC-GSFC-RD-002090
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WSC Transmission Control Protocol (TCP)/ Internet Protocol (IP) Data Interface Service Capability (WDISC System Requirements

Original